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1.0 Purpose and Scope

Electrical systems of all types, from high voltage power distribution systems to low voltage electronic circuits, are an integral part of the research and associated support work done at Fermilab. These electrical systems are inherently hazardous because the ability of the human body to safely withstand the passage of electrical current is very small. The sections following this introduction are the **POLICY** of the Accelerator Division. These policies are in addition to those contained in the Fermilab Environment, Safety, and Health Manual (FESHM).

2.0 AC Electrical Power Distribution Systems

Personnel should be aware that you must be a qualified electrician to work on the AC electrical power distribution systems as defined in FESHM Chapter 9120, *AC Electrical Power Distribution Safety*. Properly trained and qualified electrical technicians may work beyond the "point of outlet" as defined in the same chapter.

3.0 Magnet and/or Scientific Electrical Equipment

3.1 *Exposed electrical bus in access controlled areas*

The following procedures must be followed for the installation or modification of electrical equipment capable of delivering power to **exposed conductors** in areas that personnel might gain access.

The device shall be interlocked to the Beam Line Safety System if the device is capable of delivering over 50 volts or the impulse energy content exceeds 1 joule per pulse or the device is less than 50 volts and capable of delivering a current of 50 amps or more. The interlock shall be installed prior to any tests to any area to which personnel might gain access. Once the interlock is installed, only the Accelerator Division Senior Safety Officer or Designee may permit the interlock to be bypassed. Only a safety system technician may be permitted to jumper the interlock. These requirements meet or exceed the requirements of FESHM Chapter 9140, *Protection Against Exposed Electrical Bus*.

Before the device is capable of delivering power to the area, the name of the device and all other pertinent data about the device shall be given to the Accelerator Division Senior Safety Officer to ensure the proper safety precautions are taken and the determination of LOTO/Configuration Control requirements are met prior to allowing personnel access. A label shall be attached to each magnet that clearly identifies the location and name of the appropriate lockout unless that device is locked out as part of a written Lockout/Tagout procedure for any access (supervised or controlled) to the enclosure.

3.2 *Low voltage high current bus*

If the voltage is less than 50 volts but the power source is **capable** of delivering a current of 50 amps or more to an area where personnel might be present, FESHM Chapter 9160, *Low Voltage, High Current Power Distribution Systems*, must be followed.

3.3 *Additional lockout requirements*

If the output of the device is capable of >50 volts, the source of the AC power to the device must be capable of being padlocked.

3.4 *Control of non-operational equipment*

Equipment considered not to be operational shall be padlocked and tagged by the personnel responsible for the equipment.

3.5 *Magnetic field hazards*

Equipment that has no exposed electrical safety issues but would generate a magnetic field hazard that would necessitate posting and control as required by FESHM Chapter 4270, *Static Magnetic Fields*, shall be interlocked to the personnel safety system for that enclosure unless an exemption is approved by the Accelerator Division Head.

4.0 **Accelerator Configuration Control/Lockout Policy**

4.1 *Definitions*

Configuration Control - System of padlocks which use the same key for lockout of power supplies to exposed electrical hazards in All Accelerator Enclosures.

Lockout/Tagout - Laboratory system of controlling hazardous energy sources that require individuals to place Locks/Tags on the items prior to performing work on the energy source. Personnel must be trained on this system.

4.2 *Policy*

It is the policy of the Accelerator Division that prior to allowing supervised access to a tunnel enclosure, that all of the electrical equipment that provides a hazard for that access will be locked using the Configuration Control key/lock system.

The Configuration Control system was never intended to provide electrical safety for personnel **working on** the electrical supplies/components themselves. This can only be provided by following the lock-and-tag procedures which require an individual to place their lock and/or danger tag on the source of the AC power.

4.3 *Procedure*

Prior to opening the tunnel enclosures for supervised access, it is the responsibility of the Main Control Room Crew Chief to ensure a Configuration Control lockout of power supplies is conducted for that particular enclosure. The appropriate PPE shall be worn as defined in the NFPA 70E training for arc flash protection while performing the lockout. In some cases the devices locked out meet the criteria for Lockout/Tagout and are to be placed in the appropriate Group Lockout Boxes to permit Lockout/Tagout by others. The Accelerator Senior Safety Officer will be responsible for maintaining a current list of supplies that must be locked.

The Main Control Room Crew Chief shall not permit the issuance of the configuration control keys other than for the explicit function of unlocking supplies for a **SECURED** enclosure. The issuance of the keys must be logged in the access key log.

Only the Accelerator Senior Safety Officer (or designee) may permit the unlocking of a power supply connected to an unsecured enclosure.

5.0 **Power-On Access (Conventional)**

Power-on access is strongly discouraged. If a power-on access for an individual component is desired, the Accelerator Senior Safety Officer (or designee) must give permission. If the power-on access is for the entire enclosure, the Accelerator Division Head must give permission. The number of people in an enclosure during a power-on access will be limited to the maximum necessary and a minimum of two. Typically the Accelerator Senior Safety Officer (or designee) will accompany the power-on access. During the access the equipment will be powered to the minimum voltage/current necessary. Personnel who wear pacemakers are prohibited from making power-on accesses.

6.0 **Power-On Access (Superconducting Magnets)**

No access to enclosures having powered superconducting magnets will be allowed without prior approval of the Accelerator Senior Safety Officer and the Accelerator Division Head. This would require a well thought out emergency plan, minimum currents in the magnets and a justification of the necessity. Personnel who wear pacemakers are prohibited from making power-on accesses.

7.0 **Working On Scientific Equipment, Magnets, or Power Supplies**

Electrical equipment shall be locked and tagged out for repair work. Personnel shall use their own red LOTO locks and not the **Configuration Control** locks mentioned above.

When trouble shooting requires the equipment to be energized, there shall always be two persons present and the person performing the checks must be

thoroughly familiar with the equipment and the inherent dangers. The appropriate PPE shall be worn as defined in the NFPA 70E training for both electric shock protection and arc flash protection.

Manipulative operations, required in trouble shooting, shall be performed with equipment in a "positively de-energized" state whenever possible. If the connection of test equipment is to voltages exceeding 600 VAC or DC, these connections **must** be made in a "positively de-energized" state unless these connections have been brought out of the equipment specifically for testing and all connections involved are with approved high voltage connectors.

8.0 Distribution

An electronic controlled copy of this procedure is maintained on the ESH Department website at: http://ad-esh.fnal.gov/ad_adsp.html.